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ABSTRACT

The Massachusetts Educational Assessment Program (MEAP) is designed to improve curriculum and instruction in the public schools. The MEAP tests all students in grades 4, 8, and 12 in major curriculum areas biennially. The test is not designed to yield scores for individual students. This document describes the content of the assessment instruments at the different grade levels, without releasing secure test questions. For each of the four subject areas (reading, mathematics, social studies, and science) a general development framework is discussed. These frameworks give an overview of the focus of the tests by presenting the broad categories of content and processes characterizing the subject area domains for the purposes of MEAP assessment. The content dimension of each subject is then described by listing the concepts, ideas, and skills that would be included in the reporting categories or subtests. Numerous sample test questions are provided for each grade and each content category. (SLD)

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CHAPTER 188

Massachusetts Educational Assessment Program

U.S. DEPARTMENT OF EDUCATION
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The 1989 Massachusetts Educational Assessment Program:

Description of Test Content and Reporting Categories

September 1989

MASSACHUSETTS DEPARTMENT OF EDUCATION

FOREWORD

This document forms the blueprint for the Massachusetts Educational Assessment Program. The product of many hours of discussion, analysis and evaluation, it is intended to encompass the knowledge and skills that are considered integral to each of the subject areas tested. Although issued by the Department of Education, it reflects the concerns and values of educators throughout the state who have worked with the Department in its development.

At first glance, the informational aspect of each subject area may seem to predominate. Indeed, the essential topics and content are delineated as specifically as possible in order to give maximum information to school districts. However, our list of objectives is not confined to content alone. Of equal importance within each subject area is a dimension which reflects the unique kinds of thinking that are demanded by that subject. Without this dimension, representing the interaction between knowledge and the knower, there can be little true learning.

Consequently, in reading and social studies, we have stressed those critical thinking skills that are necessary in order to appraise and to appreciate historical and literary ideas. In science, we have included those processes that promote an understanding of the natural world and encourage that objectivity that we associate with scientific methods. In mathematics, we have delineated the content in terms of the kinds of thinking required: conceptual understanding, procedural knowledge, problem solving, reasoning and analysis. In brief, this document reflects a view of education that is active and ongoing. It acknowledges the common body of knowledge that defines each subject, while recognizing the need for critical participation on the part of the learner.

In some sense, this blueprint for learning represents the ideal. We doubt that any curriculum would include all the components listed. However, rather than confining our objectives to that core of learning that is common and basic to all schools, thereby limiting our vision to what students **must** achieve, we have chosen to raise our sights, to reflect what students might aim to achieve.

Commissioner of Education

ACKNOWLEDGMENTS

The Massachusetts Educational Assessment Program would not have been possible in its present form without the generous support of many individuals and school districts throughout the state. Since its inception in 1985, five Curriculum Advisory Committees have worked to develop the assessment framework, to review the test items, to interpret the results, and to give guidance and support to the entire effort.

We wish to pay special tribute to these committee members, who contributed so much to this process. We are also grateful to the school districts that supported their efforts by granting release time during the school year. The efforts of the one, the support of the other, has resulted in an assessment program that not only reflects the values and academic aspirations of Massachusetts educators, but the most profound thinking in each of the content areas.

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INTRODUCTION

The Program

In 1985, Chapter 188 of the Acts of 1985 established two uniform statewide testing programs. The Massachusetts Educational Assessment Program is designed to improve curriculum and instruction in the public schools. The Basic Skills Testing Program aims to identify and assist students who are deficient in mastery of basic skills in reading, writing and mathematics.

Under the mandates of Chapter 188, the Massachusetts Educational Assessment Program (MEAP) tests all students at three grade levels in major curriculum areas biennially. The assessment program can be thought of as a survey of a broad range of student attainments, including basic as well as higher order skills. The program is designed to produce reliable results at the school, district, and state levels, and to permit comparisons of state and national achievement levels. It is not intended to yield scores for individual students.

This year's testing, to be conducted in January and February at grade twelve and March and April at grades four and eight, is the third round of MEAP testing. In 1985-86, third, seventh, and eleventh grade students were tested in reading, mathematics, and science. In 1987-88, fourth, eighth, and twelfth graders were tested in the same subject areas plus social studies. This year, the grades and subjects tested will be the same as in 1987-88. The grade levels and subject areas tested are consistent with those targeted by the National Assessment of Educational Progress (NAEP) so that national performance comparisons can be made. Many of the test questions to be administered in Massachusetts are also being administered nationwide. The assessment instruments do not measure what is taught at a particular grade level or in a specific district, but rather cover as much as possible of the subject area domains that students might be expected to learn up to the grade level tested, encompassing the entire range of student ability and providing a challenge to all students. To provide the broad coverage of a content domain required by the assessment, large numbers of test questions must be used. In MEAP, the questions in a subject area are distributed across many different test forms, and each student completes only one form. This approach, called "matrix sampling," produces highly reliable results at the building level and above and, at the same time, minimizes testing time.

Test Development

The conduct of the assessment program is a joint effort by the Massachusetts Department of Education, a contractor for the assessment, and several curriculum advisory committees composed of teachers, curriculum specialists, and administrators from across the state. There are separate committees for reading, science, social studies, and mathematics. Initial test development tasks before first-year testing involved extensive work by advisory committees in reviewing curriculum survey results, drafting objectives, and reviewing, revising, and selecting test questions. In subsequent years, the committees reexamined the sets of test questions, revising and rejecting questions and identifying gaps in content coverage.

For the current assessment, new items were developed as needed and field tested in Massachusetts schools in the spring of 1989 for grade twelve materials and the fall of 1989 for grade four and eight materials. In addition to reviewing the questions for content and the field test results for item quality, the advisory committees also reviewed materials to be sure they were fair to and reflected balanced representation of various groups in terms of gender and ethnic, racial, and cultural backgrounds.

The committee members also advised in the construction of items to be included in student, teacher, and principal questionnaires. These instruments are designed to provide valuable information to assist in the interpretation of statewide achievement results later. They address such factors as program characteristics, teaching practices, and attitudes.

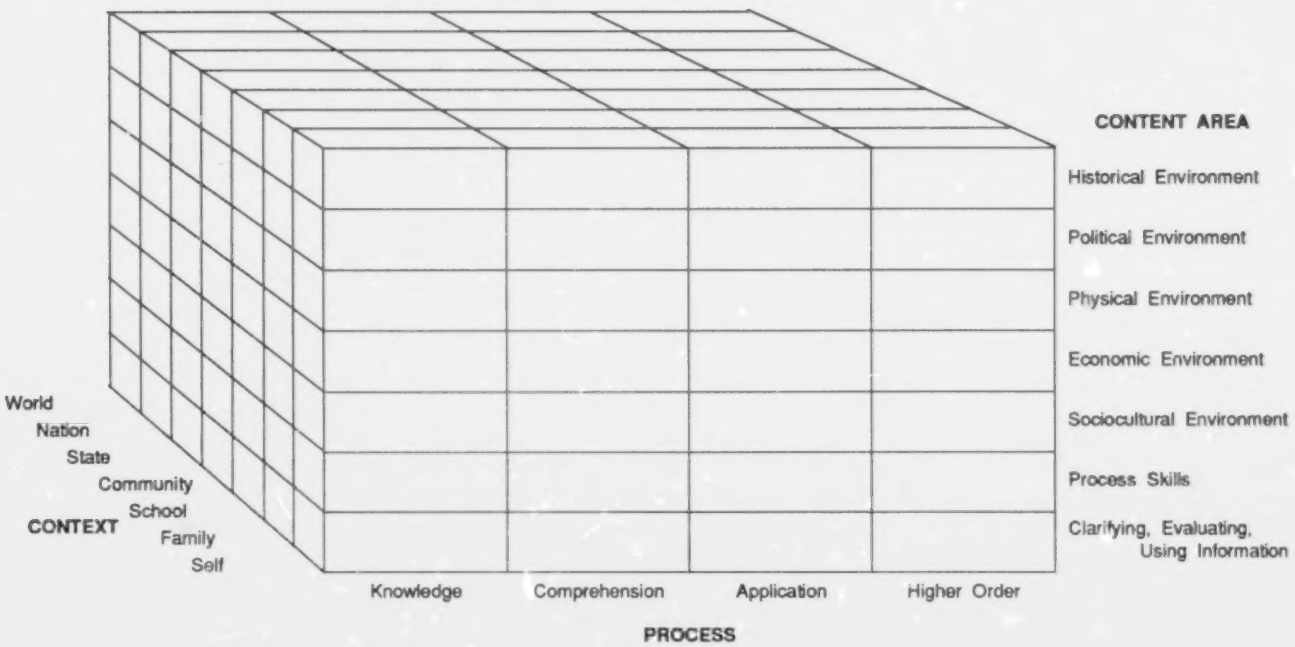
This Report

The test questions are secure and cannot be released to local school personnel either before or after test administration. For that reason, this document describes in as much detail as possible the contents of the assessment instruments at the different grade levels. For each of the four subject areas, a general development framework is discussed. These frameworks give an overview of the focus of the tests by presenting the broad categories of content and processes characterizing the subject area domains for the purposes of the MEAP assessment. Next, the content dimension of each subject area is described in great detail. This is accomplished by the listing of various concepts, ideas, and skills that would be included in the various reporting categories or "subtests." Additionally, sample test questions are provided to illustrate what test questions in categories of the other dimensions (e.g., cognitive processes or contexts) might be like.

SOCIAL STUDIES

Framework for Social Studies

The development and selection of test questions for the social studies component of the assessment were guided by the three-dimensional matrix below.



The major content categories, with the exception of **Clarifying, Evaluating, Using Information**, represent fairly traditional subdisciplines of social studies. The process categories represent types of mental or cognitive processing consistent with Bloom's Taxonomy of Cognitive Objectives described below. Social Studies achievement will be reported to schools by each process and content category, as well as by many content subcategories (described in the next section). The categories in the context dimension (world, nation, state, etc.) are not reporting categories. This dimension was used primarily as a reminder of the various contexts for social studies questions so that questions would be developed or selected to represent these contexts whenever appropriate.

The cognitive processes represent a hierarchy of mental processes required of students in answering the test questions. **Knowledge** questions require memory processes primarily. In other words, such questions address lower level skills such as factual recall. **Comprehension** questions assess the understanding of concepts and generally require students to demonstrate understanding by translating or explaining (or in the case of multiple-choice questions, identifying appropriate translations or explanations). **Application** questions assess a slightly higher level of understanding by requiring students to apply their understanding of concepts to particular situations. Bloom's "higher order" processes include analysis, synthesis, and evaluation. **Analysis** questions require the breaking down of information into parts so that ideas and their interrelationships are made explicit. **Synthesis** questions require the "pulling together" of ideas to produce a broader message or entity. **Evaluation** questions require students to make judgments about the relative value, for some purpose, of ideas, approaches, etc. In multiple-choice questions assessing this process, several response options often have some merit, but one is clearly "best" for any particular question.

One aspect of the social studies framework still requiring elaboration is the inclusion of **Clarifying, Evaluating, and Using Information** in the content dimension. What distinguishes this category from the cognitive process categories? In short, this classification refers to "critical thinking skills" and is included in the framework in response to the increasing emphasis being placed on these skills in social studies instruction.

"Critical thinking skills" is not simply another name for "higher order thinking skills." In fact, MEAP test questions assessing critical thinking skills represent a range of Bloom's cognitive processes. To make the distinction a little more difficult, the two MEAP subcategories of **Clarifying, Evaluating, and Using Information** are **Analysis** and **Evaluation** (both described in later sections of this chapter). These are not unlike Bloom's higher order processes of "analysis" and "evaluation." However, for the purposes of the MEAP assessment, test questions in the content category of **Clarifying, Evaluating, and Using Information** focus on the critical thinking skills themselves, and success in them requires minimal knowledge or understanding of other social studies content. If a higher order question requires an understanding of content, then it is placed in the appropriate content category (historical environment, political environment, etc.) and identified as "higher order" according to the process dimension. There are many such questions in the assessment.

To minimize the content the students need to bring to the task of answering critical thinking questions, the questions themselves either provide all the information necessary, or are associated with brief "passages," such as explorers' journal entries, excerpts from speeches, or courtroom arguments. To this extent, many of the critical thinking items resemble reading comprehension items. This is consistent with the growing recognition of the importance of "reading across the curricula" - the notion that all teachers have, in some way, responsibility for teaching students how to get information from written materials. The nature of curricular materials and even the role of particular types of information (e.g., assumptions) differ across the subject areas. This is not to say that social studies instruction should, at times, focus on reading or critical thinking skills in isolation. However, in evaluating student performance, it is useful to know whether poor performance is the result of a deficiency in content or skills - e.g., whether the problem is that students are not familiar enough with the Monroe Doctrine or cannot identify assumptions.

While the detailed description of test content in the following sections focuses on the content dimension of the social studies framework, the sample questions provided should help to clarify the meanings of the various process categories and contexts.

Grade 4 Reporting Categories — Content Dimension

		Estimated # Items Grade 4
I.	Historical Environment	34
	A. Specifics of History	17
	B. Sense of History	17
II.	Political Environment	30
	A. Government	15
	B. Citizenship	15
III.	Physical Environment	30
	A. Physical Geography	15
	B. Human Geography	15
IV.	Economic Environment	15
V.	Sociocultural Environment	36
	A. Social Environment	18
	B. Multicultural Environment	18
VI.	Process Skills	45
	A. Map Skills	15
	B. Graphic Representation	15
	C. Research Skills	15
VII.	Clarifying, Evaluating, and Using Information	30
	A. Analysis	15
	B. Evaluation	15
		220 items

Grade 8 and 12 Reporting Categories — Content Dimension

	Estimated # Items Grade 8	Grade 12
I. Historical Environment	74	120
A. U.S./American History	54	60
1. Pre-1865	22	20
2. Post-1865	17	20
3. Contemporary Scene	15	20
B. World History	20	60
1. Prehistory and Classical Civilizations	—	15
2. Middle Ages (Western/Eastern: 500-1600 A.D.)	—	15
3. Modern World History (Renaissance to 1900)	—	15
4. 20th Century World History	—	15
II. Political Environment	40	70
A. Government	20	50
1. Principles	—	17
2. Components	—	16
3. Processes	—	17
B. Citizenship	20	20
III. Physical Environment	30	40
A. Physical Geography	15	20
B. Human Geography	15	20
IV. Economic Environment	15	20
V. Sociocultural Environment	30	45
A. Social Environment	15	23
B. Multicultural Environment	15	22
VI. Process Skills	45	45
A. Map Skills	15	15
B. Graphic Representation	15	15
C. Research Skills	15	15
VII. Clarifying, Evaluating, and Using Information	36	40
A. Analysis	18	20
B. Evaluation	18	20
	270 items	380 items

Description of Content Categories — Grade 4

Content Description by Reporting Category	Sample Questions

HISTORICAL ENVIRONMENT

Specifics of History. Questions in this category will deal with American colonial and frontier lifestyles, contributions of significant persons and groups, important events, holidays of historical importance, and topics of some local/regional studies.

Sense of History. The emphasis in this category will be students' sense of the past, ancestry, change, and connections of self/family/community to history. Attention will be given to how lifestyles have changed over the centuries, and the relationship between the past and the present.

POLITICAL ENVIRONMENT

Government. Topics covered in this category include the role of rules, laws, and government; making, changing, enforcing rules and laws; basic levels of government (local and national); democratic principles (e.g., majority rule); recognition and role of historical U.S. documents; significant individuals; and songs and symbols of the U.S.

Citizenship. The emphasis in this category is on the rights and responsibilities of group membership at various levels, such as school, community, town. Also included in this category are rights and liberties guaranteed by the Constitution and important democratic attitudes and values (e.g., willingness to cooperate and participate within a group).

PHYSICAL ENVIRONMENT

Physical Geography. This category covers topics such as place geography, surface features, climate patterns, vegetation, and natural resources.

Human Geography. Topics include population density and clustering; cultural geography; influence of geography on various aspects of life; environmental problems; and humans' adaptation to, use of, and protection of the environment.

ECONOMIC ENVIRONMENT

Fundamental economic concepts covered include the basics of buying and selling, products and services, production costs and profit, simple aspects of specialization/division of labor, supply and demand, needs and wants, effects of limitation on productive resources, the role of government (e.g., services, taxes), global economic interaction and various ideas pertaining to personal economics.

The phonograph, the electric light, and the motion picture machine were invented or improved by

A. Thomas Edison.
B. Benjamin Franklin.
C. George Washington Carver.
D. Eli Whitney.

Content: Specifics of History
Process: Knowledge
Context: Nation

During the 1800s, people traveled west across the country by all of the following EXCEPT

A. train.
B. covered wagon.
C. airplane.
D. steamboat.

Content: Sense of History
Process: Higher Order
Context: Nation

Rules are MOST IMPORTANT because they

A. create jobs for people.
B. help people live together.
C. make everyone think alike.
D. punish people who break them.

Content: Government
Process: Comprehension
Context: [multilevel]

All adult citizens in the United States have the right to

A. appoint a police chief.
B. vote in elections.
C. teach in a school.
D. command an army.

Content: Citizenship
Process: Knowledge
Context: Nation

One of the first discoveries that helped people settle dry regions was

A. plowing.
B. irrigation.
C. fire.
D. trading.

Content: Human Geography
Process: Higher Order
Context: World

If you wanted to earn money during the winter, what could you do for a neighbor?

A. go ice skating
B. shovel snow
C. build a snowman
D. buy a new coat

Content: Economic Environment
Process: Higher Order
Context: Self

SOCIOCULTURAL ENVIRONMENT

Social Environment. This category covers aspects of social structure — the various elements of a society such as social institutions (family, religion, education) and social organization (roles of different elements — e.g., community helpers, interest groups, relationships among groups). Also included in this area is social change (how changes take place, causes and effects of change) and social problems.

Multicultural Environment. Cultural similarities and differences (including cultural universals such as basic needs) as well as cultural transmission and interaction are the focus of questions in this category. Included are cultural variations and interactions within communities, countries, and around the globe.

PROCESS SKILLS

Map Skills. Traditional map skills require familiarity with maps and globes, ability to read and use maps and map legends/symbols, and understanding of scale.

Graphic Representation. Questions in this area require students to read and interpret information depicted graphically in social studies contexts. Different types of charts and graphs as well as timelines will be included.

Research Skills. This category includes some general referencing skills and knowledge of resources, but also covers problem solving skills and data gathering techniques typical of social studies research.

CLARIFYING, EVALUATING, AND USING INFORMATION

Analysis. The analytic skills frequently considered in the domain of critical thinking are included here. These skills require students to clarify information provided to them by identifying types of information (e.g., distinguishing fact and opinion, recognizing assumptions), essential ideas, and relationships among expressed ideas - cause and effect, time sequence of events, common characteristics (comparing and contrasting).

Evaluation. Evaluative skills include the weighing of evidence and the drawing and evaluating of inferences based on information provided. In other words, students must use information to make judgments. The judgments might be inferences about causes of actions or events or outcomes of actions or events, including projected outcomes. Evaluation of evidence also includes the evaluation of sources of evidence.

Groups of people will most often work best together when they

A. share the same goals.
B. live in the same town.
C. need to use the same materials.
D. have different backgrounds.

Content: Social Environment
Process: Higher Order
Context: [multilevel]

Native Americans needed to depend on each other, so families joined together to form

A. tribes.
B. towns.
C. clubs.
D. states.

Content: Multicultural Environment
Process: Knowledge
Context: Community

Where could you find information about candidates running for political office in your community?

A. national news television program
B. local newspaper
C. magazines
D. books

Content: Research Skills
Process: Application
Context: Self/School

The teacher found a Larry Bird T-shirt and asked the class, "Does this belong to any of the boys in this class?" The teacher must believe that

A. the T-shirt would not fit any of the girls.
B. only boys would own a Larry Bird T-shirt.
C. boys are better athletes than girls.
D. girls do not misplace things.

Content: Analysis
Process: Higher Order
Context: [multilevel]

[PASSAGE PROVIDED]

What is the strongest evidence in the story that it took place many years ago?

A. The radio was called a "new invention."
B. The teacher wore a heavy woolen overcoat.
C. The travelers were tired.
D. The church steeple needed painting.

Content: Evaluation
Process: Higher Order
Context: [multilevel]

Description of Content Categories — Grade 8

Content Description by Reporting Category	Sample Questions

HISTORICAL ENVIRONMENT

U.S./American History. Questions in this category will require the understanding and use of important concepts and ideas associated with various periods, eras and themes in U.S. history. Pre-1865 topics include the age of exploration, pre-Columbus America, colonialism and the American colonies, the making of the new republic, westward expansion, and sectionalism and division.

Post-1865 topics include the growth of industrial America, urbanization, and the emergence of the U.S. as a world power. The contemporary scene refers to the post-1974 period and includes current events. Appropriate attention will be given to various themes such as Native American history, minority history, Massachusetts history, and significant U.S. personalities.

World History. Sets of test questions will pertain to prehistory and classical civilizations (e.g., early humans and ancient Greece, Rome, Egypt, China); the Middle Ages — eastern/western, 500-1600 A.D. (e.g., early church, state, hemispheric interaction — trade, commerce, exploration); modern world history — Renaissance to 1900 (e.g., ages of discovery, enlightenment, revolution); and 20th century world history (e.g., growth of third world nations, international conflict/ideologies, technical revolution — atomic age, space age).

POLITICAL ENVIRONMENT

Government. Questions about government require the understanding and use of important concepts and ideas associated with the need for government and the origins of political principles, major historical documents as they relate to U.S. and state government, forms of government and democracy specifically, separation of power, and checks and balances.

Citizenship. Questions in this category require the understanding and use of important concepts and ideas associated with such topics as rights and liberties guaranteed by the Constitution, and responsibilities of citizens in a democratic system (tolerance, participation). Questions pertain to rights and responsibilities of group membership at various levels — school, town, state, nation.

Puritan religious beliefs dominated government and social customs in the

A. New England colonies.
B. Mid-Atlantic colonies.
C. Southern colonies.
D. West Indies colonies.

Content: U.S./American History
Process: Knowledge
Context: Nation

[PICTURE OF "CRUSADERS" GIVEN]

During what time period would figures such as these have appeared?

A. 200 B.C. to 100 A.D.
B. 150 A.D. to 400 A.D.
C. 500 A.D. to 1600 A.D.
D. 1600 A.D. to 1800 A.D.

Content: World History
Process: Knowledge
Context: World

It takes a two-thirds majority of each house for Congress to override the President's veto of a bill. Generally, it is difficult for backers of such a bill to gain the necessary two-thirds majority if the

A. bill passed by a two-thirds majority the first time.
B. President's party has a majority in Congress.
C. bill concerns appropriations of money.
D. Speaker of the House allows further debate.

Content: Government
Process: Higher Order
Context: Nation

Which of the following is NOT a legal way in which U.S. citizens may oppose laws or the actions of officials?

A. participation in boycotts
B. nonpayment of taxes
C. written letters of protest to authorities
D. recall of legislators

Content: Citizenship
Process: Knowledge
Context: Nation

PHYSICAL ENVIRONMENT

Physical Geography. Questions in this category require the understanding and use of important concepts and ideas associated with place geography, surface features, climate patterns, vegetation, and natural resources.

Human Geography. Topics include population density and clustering; cultural geography; influence of geography on politics, economics, culture; agriculture; environmental problems; and humans' adaptation to, use of, and protection of the environment.

ECONOMIC ENVIRONMENT

Questions in this category require the understanding and use of important concepts and ideas associated with topics such as capitalism and other economic systems, scarcity, markets, supply and demand, competition, factors influencing consumer purchasing power, the role of government in the economy, and world economic interdependence. Attention in the assessment will also be given to aspects of personal economics.

SOCIOCULTURAL ENVIRONMENT

Social Environment. The questions in this category require the understanding and use of important concepts and ideas associated with social structure — the various elements of a society such as social institutions (family, religion, education) and social organization (roles of different elements, stratification, interest groups, relationships among groups). Also included in this area is social change — change processes; causes and effects of change; and social problems.

Multicultural Environment. The questions in this category require the understanding and use of important concepts and ideas associated with cultural similarities and differences (including cultural universals — basic needs), contributions of different cultures to society, and cultural transmission and interaction.

PROCESS SKILLS

Map Skills. Traditional map skills require familiarity with maps and globes and the ability to interpret and use maps.

Graphic Representation. Questions in this area require students to read, interpret, and use information depicted graphically within a social studies context. Different types of graphs, pictures, political cartoons, and timelines will be included.

Research Skills. This category includes general reference skills and knowledge of resources, problem solving skills and data gathering techniques typical of social studies research.

[MAP GIVEN]

Which region identified on the map is the most heavily populated?

A. Region 1
B. Region 2
C. Region 3
D. Region 4

Content: Human Geography
Process: Knowledge
Context: World

What is MOST LIKELY to happen when an item which many people want to purchase becomes scarce?

A. People lose their desire for the item.
B. People stop using money and begin using coupons.
C. People have to pay higher prices to purchase the item.
D. People form consumer groups to make sure the item is distributed fairly.

Content: Economics
Process: Application
Context: [multilevel]

Which of the following is LEAST likely to be found in a rural community?

A. natural resources
B. medical facilities
C. public transportation
D. shopping areas

Content: Social Environment
Process: Higher Order
Context: Community

Which of the following BEST reflects the views Native Americans held toward the land?

A. They encouraged private ownership of the land.
B. Their views were similar to those of the American colonists.
C. They encouraged public ownership of the land.
D. They felt that the land was to be used but not owned.

Content: Multicultural Environment
Process: Knowledge
Context: Nation

[MAP WITH SCALE GIVEN]

Approximately how far was Babylon from the Indus River?

A. 900 miles
B. 1500 miles
C. 2200 miles
D. 2600 miles

Content: Map Skills
Process: Application
Context: World/Self

CLARIFYING, EVALUATING, AND USING INFORMATION

Analysis. Questions in this category are from the domain of critical thinking. The skills covered require students to clarify information provided to them by identifying types of information (facts, value judgments, assumptions, generalizations, etc.), essential ideas, and relationships among ideas.

Evaluation. Evaluative skills include the weighing of evidence and the drawing and evaluating of inferences based on information provided. In other words, students must use information to make judgments. The judgments might be inferences about causes of actions or events or outcomes of actions or events, including projected outcomes. E aluation of evidence also includes the evaluation of sources of evidence.

Which of the following topics would be LEAST important to study before making a decision about the location of a new dumpsite?

A. the impact of the possible sites on the water supply
B. the views of the local residents
C. the importance of the current uses of the sites
D. the condition of the community's garbage trucks

Content: Research Skills
Process: Higher Order
Context: Community

[PASSAGE PROVIDED]

Mrs. Smith's comments show that she *assumed*

A. everyone in the auditorium wanted to be there.
B. the students had no homework to do that evening.
C. the principal was basically in agreement with her.
D. the other teachers had completed their assigned tasks.

Content: Analysis
Process: Higher Order
Context: School

[PASSAGE PROVIDED]

What conclusion is *best* supported by the testimonies of the witnesses?

A. The defendant should be found innocent.
B. A crime had been committed by someone.
C. The police acted responsibly.
D. Some of the witnesses were lying.

Content: Evaluation
Process: Higher Order
Context: Community

Description of Content Categories — Grade 12

Content Description by Reporting Category

HISTORICAL ENVIRONMENT

U.S./American History. Questions in this category will require the understanding and use of important concepts and ideas associated with various periods or eras in U.S. history. Pre-1865 eras include: pre-Columbus — the first Americans, the age of exploration (before 1600), the early colonies (1580-1700), colonial development (1700-1763), pre-war controversies and revolution (1763-1783), the new nation (pre-1800), democratic republicans (1800-1824), the age of Jackson (1824-1840), nationalism and manifest destiny (1820-1850), and sectionalism/secession/civil war (1850-1865).

Post-1865 eras include the aftermath of war and the emergence of Modern America (1865-1900); the rise of the U.S. as a world power (1880-1918); the era of reform (1890-1917); postwar prosperity (1918-1929); the Great Depression (1929-1939); from neutrality to global war (1930-1945), the postwar era — peacetime conversions and the Cold War (1945-1964); and developments at home and abroad (1964-1974). The contemporary scene refers to the period after 1974 and includes current events.

World History. Sets of test questions will pertain to prehistory and classical civilizations (e.g., early humans and ancient Greece, Rome, Egypt, China); the Middle Ages — eastern/western, 500-1600 A.D. (e.g., early church, state, Africa, pre-Columbus America — Aztecs/Incas); modern world history — Renaissance to 1900 (e.g., Age of Discovery, Enlightenment, development of nation states, Age of Revolution — political, economic, social); and 20th century world history (e.g., growth of third world nations, international conflict/ideologies, technical revolution — atomic age, space age).

POLITICAL ENVIRONMENT

Government — Principles. Questions in this category will relate to such things as the need for government and the origins of political principles; major historical, political documents; comparative political systems.

Government — Components. Roles and responsibilities (e.g. judicial review, separation of powers/checks and balances) will be emphasized in questions about U.S. governmental branches (executive, legislative, judicial), levels (national, state, local), and institutions (House, Senate, Cabinet, State Department).

Sample Questions

Who was considered a champion of the common people and an enemy of "privilege"?

A. Thomas Jefferson
B. James Madison
C. Andrew Jackson
D. James Monroe

Content: U.S./American History - Pre-1865
Process: Knowledge
Context: Nation

In the study of the Middle Ages in Europe, which of the following topics is LEAST important?

A. the exploration of the New World
B. the growth of commerce and the rise of towns
C. the power and influence of the church
D. the decline of feudalism and the rise of the king-state

Content: World History - Middle Ages
Process: Higher Order
Context: World

At the Constitutional Convention it was decided that some powers would be held by the national government and others by the state governments. This arrangement is an example of

A. federalism.
B. socialism.
C. democracy.
D. nationalism

Content: Government - Principles
Process: Knowledge
Context: Nation

When might a state have more senators than it has representatives in the United States Congress?

A. when it has a large area
B. when it has a small area
C. when it has a large population
D. when it has a small population

Content: Government - Processes
Process: Application
Context: Nation/State

Government - Processes. Questions in this category will address electoral, judicial, legislative, and executive processes and cover such topics as primary and general elections, constitutional changes to popular vote, changing the law, committee work, and the grand jury.

Citizenship. This category covers the rights and responsibilities of group membership at various levels — school, town, state, nation. Questions will cover such topics as rights and liberties guaranteed by the Constitution, and responsibilities of citizens in a democratic system (tolerance, participation).

PHYSICAL ENVIRONMENT

Physical Geography. This category covers topics such as place geography, surface features, water systems, climate patterns, vegetation, and natural resources.

Human Geography. Topics include population density and clustering; cultural geography; influence of geography on politics, economics, and culture; agriculture; environmental problems; and human adaptation to, use of, and protection of the environment.

ECONOMIC ENVIRONMENT

Fundamental economic concepts covered include scarcity, trade-offs, productivity, comparative economic systems, and economic institutions. Topics related to how markets work include supply and demand, competition, other factors influencing prices and consumer purchasing power. Aspects of the national and international economy are also addressed.

SOCIOCULTURAL ENVIRONMENT

Social Environment. This category covers aspects of social structure — the various elements of a society such as social institutions (family, religion, education) and social organization (roles, stratification, interest/ethnic/religious groups, relationships among groups). Also included in this area is social change — change processes; causes and effects of change; and social problems, conflicts, and issues.

Multicultural Environment. The questions in this category require the understanding and use of important concepts and ideas associated with cultural similarities and differences (within the U.S. and internationally), contributions of different cultures to society, and cultural transmission and interaction. Also covered are aspects of psychology (e.g., motivation, perception, development) as they relate to human social behavior and interaction and to cultural differences.

In June of 1975, Steve Nelson was arrested for selling marijuana cigarettes to an undercover officer. The officer was the only witness against Steve. At the trial, Steve's lawyer wanted to question the officer. The police department would not let the officer testify because they feared it would blow the officer's cover. Steve was convicted and sentenced to one year in jail. Which civil right, if any, has been violated?

A. freedom of speech
B. protection against self-incrimination
C. right to confront witnesses
D. No civil right has been violated.

Content: Citizenship
Process: Application
Context: Self

Which of the following is NOT a major controversial issue associated with the use of nuclear power?

A. disposal of nuclear waste products
B. health hazards in areas surrounding nuclear plants
C. thermal pollution of water bodies used for cooling
D. unemployment due to conversion to nuclear power

Content: Human Geography
Process: Higher Order
Context: Community

If the law of supply and demand works, the farmer will obtain the highest price for crops when

A. both supply and demand are great.
B. both supply and demand are low.
C. supply is great and demand is low.
D. supply is low and demand is great.

Content: Economic Environment
Process: Application
Context: [multilevel]

There were several cultural differences between European settlers in America and the Native American population during the period of Westward Movement. Differing views regarding which of the following concepts was the source of the GREATEST conflict?

A. ownership of land
B. functions of a family
C. religious beliefs
D. role of government

Content: Multicultural Environment
Process: Higher Order
Context: Nation

PROCESS SKILLS

Map Skills. Traditional map skills require familiarity with different types of maps and globes, ability to read and use maps and map legends/symbols, and understanding of scale, coordinates, direction.

Graphic Representation. Questions in this area require students to read and interpret information depicted graphically as it might appear in social studies contexts. Different types of graphs as well as time lines and political cartoons will be included.

Research Skills. This category includes some general referencing skills and knowledge of resources, but also covers skill at identifying problems and developing focus and approach for investigations and data gathering techniques typical of social studies research.

CLARIFYING, EVALUATING, AND USING INFORMATION

Analysis. Questions in this category are from the domain of critical thinking. The skills covered require students to clarify information provided to them by identifying types of information (facts, value judgments, assumptions, generalizations, etc.), essential ideas, and relationships among ideas.

Evaluation. Evaluative skills include the weighing of evidence and the drawing and evaluating of inferences based on information provided. In other words, students must use information to make judgments. The judgments might be inferences about causes of actions or events or outcomes of actions or events, including projected outcomes. Evaluation of evidence also includes the evaluation of sources of evidence.

[MAP WITH SCALE PROVIDED]

Approximately how far was Babylon from the Indus River?

A. 900 miles
B. 1500 miles
C. 2200 miles
D. 2600 miles

Content: Map Skills
Process: Application
Context: World/Self

A researcher wanted to survey students in a high school to determine students' attitudes about the importance of sports in that school. To find students to complete the survey, it would be BEST for the researcher to randomly select names from a list of all students who

A. play on an athletic team.
B. attend sports events but do not play.
C. attend the school.
D. have grades placing them in the top half of their classes.

Content: Research Skills
Process: Higher Order
Context: School

[PASSAGE PROVIDED]

The ideas expressed in the sentences of the first paragraph are examples of

A. assumptions.
B. facts.
C. predictions.
D. value judgments.

Content: Analysis
Process: Higher Order
Context: [multilevel]

[PASSAGE PROVIDED]

Which conclusion is BEST supported by evidence in the passage?

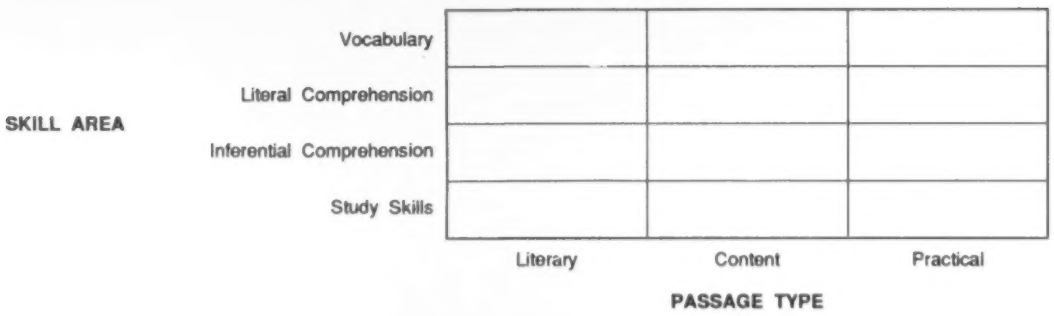
A. The employees' rights were not being respected.
B. The union officials knew best what had to be done to solve the problem.
C. The company's attorney was primarily concerned with justice.
D. Management was wrong, and labor was right.

Content: Evaluation
Process: Higher Order
Context: Community

READING

Framework for Reading

The development of the MEAP reading tests was guided by the framework depicted below.



The skill areas and the passage types will be reporting categories for school results — that is, school scores will be produced for each of these categories. The next sections of this report describe in much greater detail the skill categories and subcategories for which school scores will also be produced.

People read different types of reading material for different purposes and using different strategies. Thus, effective reading instruction should involve variety in the types of reading assignments. Literary passages are, of course, passages such as short stories, excerpts from larger literary pieces, poems, etc. Content passages are informational pieces, often from textbooks or other materials used to supplement textbook reading. Practical passages are such things as sets of directions, manuals, order forms, and reference tools. The reading of practical passages is often followed by some action in a nontesting situation.

Grade 4, 8, and 12 Reporting Categories — Skill Area Dimension

	Estimated # Items		
	Grade 4	Grade 8	Grade 12
I. Vocabulary	15	22	27
II. Literal Comprehension	18	13	16
III. Inferential Comprehension	90	108	138
A. External Perspective	30	36	46
B. Internal Perspective	60	72	92
1. Analyzing Meaning	30	36	46
2. Evaluating Ideas	30	36	46
IV. Study Skills	20	37	47
A. Using Reference Materials	–	13	16
B. Following Directions	–	12	16
C. Summarizing/Organizing	–	12	15
	143 items	180 items	228 items

Description of Skill Areas - Grades 4, 8, and 12

Skill Area Description by Reporting Category

VOCABULARY

At grade 4, the assessment questions in this category will address the traditional skills of understanding the meanings of words in context and identifying synonyms and antonyms. At grades 8 and 12, the skills tested will include understanding the meanings of words in context, identifying and using affixes and roots, and drawing analogies. (Note: Analogies test verbal reasoning requiring higher-level thought processes whereas traditional vocabulary questions assess isolated word meanings. A few analogy questions will be used at grade 4, and the emphasis on this type of question will increase with grade level.)

LITERAL COMPREHENSION

This category is not broken down further as it often is because, in a testing situation, multiple-choice questions addressing literal comprehension tend to cover the same skill — locating specific information in a passage.

INFERENTIAL COMPREHENSION

The objectives covered in this area represent a merging of traditional reading objectives and current theory in reading. The two major categories within inferential comprehension are "External Perspective" and "Internal Perspective."

Questions under "External Perspective" pertain to the type of information on the page (genre, purpose, format) and **not** what the words say. Also covered in this category are ways readers approach the task of reading which are dependent, in part, on the type of information.

The category of "Internal Perspective" includes many traditional reading comprehension skills and focuses mainly on **meanings** the reader constructs from the text.

Below, lists of skills and sample test questions are presented for each of the reporting categories within inferential comprehension.

External Perspective.

- identify genre (type of selection)
- recognize meaning/purpose of structural and organizational cues (headings, italicized words, etc.)
- associate genre with its characteristics (purpose/structure)

Sample Questions

NOTE: While the sample reading questions as a set represent a wide range in terms of grade-level appropriateness, any particular sample question may only be appropriate at one of the grade levels assessed. Sample items are included here merely to illustrate the skills identified in the narrative on the left.

[PASSAGE PROVIDED]

What is the **best** meaning of the word **ferret** as it is used in the passage?

A. distribute
B. search
C. weasel-like
D. discard

Skill Area: Vocabulary - Meaning of words from context

Throne is to **chair** as **castle** is to

A. moat.
B. canopy.
C. house.
D. palace.

Skill Area: Vocabulary - Analogies

Which word means to **speak against**?

A. addict
B. predict
C. interdict
D. contradict

Skill Area: Vocabulary - Affixes

NOTE: All literal and inferential comprehension questions are related to passages.

When did television broadcasting equipment become available for public use?

A. during the 1950s
B. after a large antenna was connected to the central receiving station
C. after people paid a small fee which allowed them to view cable programs
D. since local cable studios have emerged

Skill Area: Literal Comprehension

In the third paragraph, the word *tempura* is printed in italics because it is

A. the most important word in the paragraph.
B. part of a direct quotation.
C. being used in an unusual way.
D. a word from a foreign language.

Skill Area: External - Structural Cues

- recognize topics in which prior knowledge would benefit comprehension
- identify author's purpose, point of view, tone
- evaluate relevance and reliability of prior knowledge and sources
- make predictions about the structure and types of information in the text
- evaluate and select reading strategies
- evaluate and adjust chosen strategies (including self-checking and drawing analogies)

Internal Perspective — Analyzing Meaning.

- distinguish fact from opinion
- recognize inferences and/or conclusions (including generalizations, predictions, and deductions)
- recognize assumptions
- identify causal relationships (cause and effect both stated)
- identify similarities and differences (compare, contrast, categorize)
- recognize ambiguity and equivocation
- associate reasons with conclusions
- recognize analogies
- identify main ideas
- summarize

Internal Perspective — Evaluating Ideas.

- identify propaganda/bias
- evaluate expertise/reliability of sources
- assess quality of information
- evaluate evidence/inferences of author and characters
- draw and evaluate inferences about causes
- draw and evaluate inferences about effects
- make and evaluate generalizations (including identifying theme)

STUDY SKILLS

At grade 4, scores for separate subcategories of study skills are not being reported. Assessment questions address the skills of using reference materials (e.g., dictionary, table of contents), following directions, and classifying/categorizing. At grades 8 and 12, separate reporting categories include:

- Using Reference Materials (e.g., parts of books, dictionaries)
- Following Directions
- Summarizing/Organizing (including outlining skills)

This type of passage usually presents all of the following except

A. conflicting opinions.
B. extensive technical jargon.
C. eyewitness accounts.
D. facts and statistics.

Skill Area: External - Associate genre with characteristics

The first paragraph of this passage makes you believe the passage will

A. present opposing views on the issue.
B. express the author's view and present evidence for that viewpoint.
C. poke fun at those who believe in Ogopogo.
D. criticize those who doubt Ogopogo's existence.

Skill Area: External - Make predictions about types of information

---

A good strategy for reading a short story such as this one is to

A. skim through quickly, looking for main ideas.
B. scan rapidly, looking for names, dates, and places.
C. read at a comfortable pace, paying attention to the development of plot and characters.
D. read slowly and carefully, stopping often to summarize paragraphs.

Skill Area: External - Evaluate/select reading strategies

Why did the author ask the question, "If a great many of the leaders were from the poorer classes, what kind of clue might that give us?" The author

A. wanted to vary the sentence type to make the material more readable.
B. wanted to introduce the idea that the revolutionary leaders were from the poorer classes.
C. wanted the reader to know that much about history is still not known.
D. wanted the reader to pause and think about the answer to better understand the material.

Skill Area: External - Self checking

In making the statement, "Many times a general household cleaner is just as effective as a specialized product," the author is assuming that *general* household cleaners are

A. cheaper.
B. nontoxic.
C. available.
D. effective.

Skill Area: Internal Analysis - Recognize assumptions

Sample Questions

Chris asked Mrs. Adams for the cleaning job. Chris must have believed that

A. Mrs. Adams was the boss.
B. the office was very messy.
C. the job would pay well.
D. there would be plenty of help.

Skill Area: Internal Analysis - Recognize assumptions

Look at the brief description of some of the signers of the Declaration of Independence. Judging from this list, what kind of people were the leaders of the American Revolution?

A. small farmers
B. people from the South
C. wealthy and well-educated
D. people from the poorer classes

Skill Area: Internal Analysis - Identify similarities and differences

---

To Ooka, the sound of money is equivalent to the

A. greed of the shopkeeper.
B. smell of food.
C. freshly prepared tempura.
D. guilt of the student.

Skill Area: Internal Analysis - Recognize analogies

Which of the following points of view from the passage seems to be most biased?

A. Ogopogo is a commercial success.
B. The Lake Okanagan area is appealing to tourists.
C. The Chamber of Commerce values truth less than profit.
D. Ogopogo is probably a reptilian creature.

Skill Area: Internal Evaluation - Identify bias

Whose claim that the creature really exists is most believable?

A. Arlene Gaal
B. Lionel Edmond
C. a Chamber of Commerce spokesperson
D. a tourist with a snapshot of the creature

Skill Area: Internal Evaluation - Reliability of sources

Which of the following conclusions is best supported by evidence?

A. Some evidence was faked.
B. Ogopogo is reptilian.
C. The creature is related to a sturgeon.
D. Indians have seen Ogopogo.

Skill Area: Internal Evaluation - Evaluate evidence/inferences of author or characters

Sample Questions

After Ooka explained his unusual verdict, the shopkeeper probably felt

A. satisfied.
B. bored.
C. humiliated.
D. relieved.

Skill Area: Internal Evaluation - Inferences about effects

[INDEX PROVIDED]

On what page would an explanation of soil erosion begin?

A. 97
B. 98
C. 100
D. 105

Skill Area: Study Skills - Using reference materials/parts of books

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[DIRECTIONS PROVIDED]

According to the directions, what would a person who rolled a 7 have to do?

A. roll again
B. move back 10 spaces
C. miss a turn
D. take a card

Skill Area: Study Skills - Following directions

[PASSAGE PROVIDED]

I. Object of Game
II. Positions
  A. Offensive
  B. Defensive
III. _____
IV. Appeal of Game

An incomplete outline of the passage is shown above. What heading would be most appropriate for III?

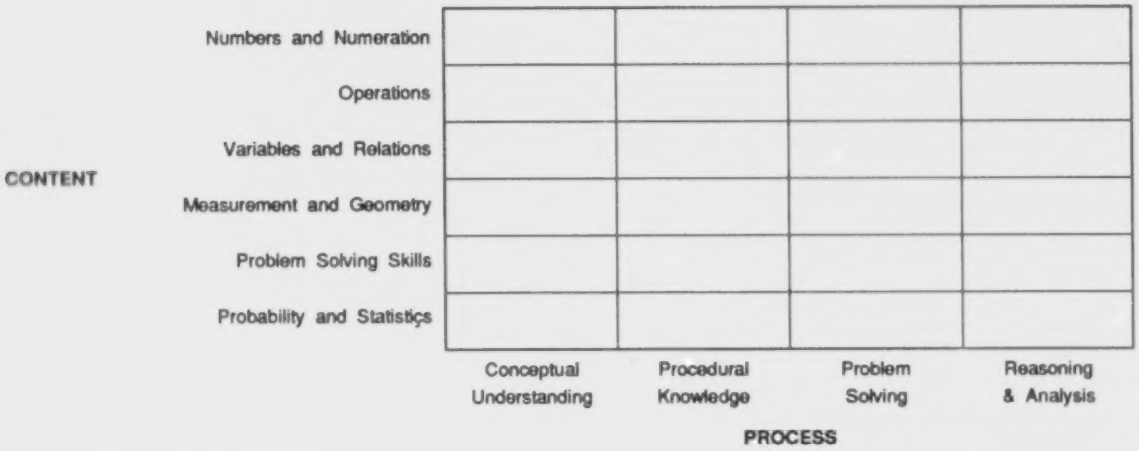
A. Penalties
B. Strategies
C. Required Equipment
D. Popularity of Sport

Skill Area: Study Skills - Summarizing/organizing

MATHEMATICS

Framework for Mathematics

The mathematics component of the assessment was developed to fit the content-by-process matrix below.



The process categories, the content categories, and many content subcategories (described in the next section) will be reporting categories for school results — i.e., areas for which school scores will be produced. While the narrative in the next section describes in detail the content dimension, the sample items illustrate the kinds of questions that might be asked in the various process categories.

The process categories represent a departure from the process categories for mathematics previously used in the Massachusetts assessment and by the National Assessment of Educational Progress. Instead of a modification of Bloom's Taxonomy of Cognitive Objectives, these categories are the result of the recent work of Standards Committees of the National Council of Teachers of Mathematics (NCTM). The standards (or categories), which are still being refined by NCTM, represent types of reasoning more tailored to the domain of mathematics.

Test questions assessing students' **Conceptual Understanding** in mathematics provide evidence of their abilities to label, verbalize, and define the concept; recognize and generate examples and nonexamples; use models, diagrams, and symbols to represent the concept; translate from one mode of representation to another; and compare, contrast, and integrate related concepts. **Procedural Knowledge** is evidenced by demonstrated abilities to reliably and efficiently execute procedures and verify their results empirically (e.g., using models) or analytically; verbalize and give reasons for the steps in a procedure; recognize correct and incorrect procedures; generate new procedures and extend or modify familiar ones; and recognize situations in which a procedure is appropriate or necessary or correctly apply it. ("Procedures" include, but are not limited to, computational algorithms.)

Students' ability to use their knowledge of mathematics for **Problem Solving** is demonstrated by evidence that they can recognize and formulate problems by identifying the key features and questions in a given situation; solve problems by selecting and using appropriate strategies, models, and relevant mathematical content; and verify and generalize solutions by critically reflecting on the problem. The assessment of **Mathematical Reasoning and Analysis** requires students to use standard forms of reasoning such as inductive, deductive, and statistical inference; use contextual reasoning such as proportional and spatial reasoning; and identify and examine components of a given situation to abstract commonalities, specify properties and relationships, and identify underlying structure. Sample questions in the next sections should help to clarify the meanings of these processes further.

Grade 4, 8, and 12 Reporting Categories — Content Dimension

	Estimated # Items		
	Grade 4	Grade 8	Grade 12
I. Numbers and Numeration	33	30	39
A. Numeration	18	15	19
B. Number Theory	15	15	20
II. Operations	41	84	88
A. Whole Numbers	21	17	26
B. Fractions (and Decimals at grade 4)	16	15	16
C. Decimals	–	15	16
D. Percent	–	15	15
E. Integers	–	10	15
F. Properties of Operations	*4	12	–
III. Variables and Relations	15	21	60
A. Algebraic Manipulations			20
B. Relations/Functions			20
C. Equations/Inequalities			20
IV. Measurement and Geometry	65	75	98
A. Using Instruments	15	15	15
B. Units	15	15	20
C. Perimeter, Area, Volume	*5	15	20
D. Plane/Solid Figures	15	15	25
E. Transformations/Spatial Visualization	15	15	18
V. Problem Solving Skills	36	45	48
A. Estimation and Reasonableness	12	15	16
B. Strategies	12	15	16
C. Relevant Information	12	15	16
VI. Probability and Statistics	30	30	47
A. Probability (and Statistics at grades 4 and 8)	15	15	15
B. Statistics	–	–	15
C. Graphs, Tables, Charts	15	15	17
	220 items	285 items	380 items

* not reported separately

Description of Content Categories — Grade 4

Content Description by Reporting Category	Sample Questions

NUMBERS AND NUMERATION

Numeration. Topics and skills in this category include place value, number order, translation of pictures (e.g., base-10 figures) to numerals, rounding to the nearest ten, interpolation using the number line, and recognition of simple fractional parts.

Number Theory. Topics covered include number sequences, odd and even numbers, prime numbers, common multiples (e.g., counting by 3s and 5s), set membership given diagrams.

OPERATIONS

Whole Numbers. Assessment questions in this category cover computation (addition, subtraction, multiplication with/without regrouping, simple division) as well as story problems (routine, nonroutine, one-step, and two-step).

Fractions/Decimals. This category includes addition and subtraction of simple fractions, computations involving money, and story problems requiring these skills (e.g., fractional part of an object remaining, costs, cost differences, change).

Properties of Operations. Questions in this category stress the understanding and application (and not knowledge of terminology) of properties, such as the commutative and associative properties; and concepts of operations (e.g., multiplication as repeated addition).

VARIABLES AND RELATIONS

Questions in this category deal with such things as solving number sentences (including missing addends/factors), translating pictures to number sentences and vice versa, and determining and applying a "rule" (e.g., function machines).

MEASUREMENT AND GEOMETRY

Using Instruments. Questions in this category will cover knowledge of appropriate instruments for particular situations and reading of instruments (e.g., clock, metric and English rulers, thermometers, scales).

Units. This category covers the recognition of appropriate metric and English units for use in measuring various quantities (e.g., distance/length, weight); recognition and use of unit equivalents in problems involving money, time, length, weight, etc.; and the relationship between measurement (quantity) and size of measurement unit.

What digit is in the hundreds place in the number in the box?

37,642

A. 3
B. 7
C. 6
D. 4

Content: Numeration
Process: Conceptual Understanding

What fraction is shown by the shaded part of the circle?

A. $\frac{1}{2}$
B. $\frac{2}{1}$
C. $\frac{2}{3}$
D. $\frac{3}{2}$

Content: Numeration
Process: Conceptual Understanding

You say this number when you count by 2s. You say the same number when you count by 3s. Which of the following could be this number?

A. 3
B. 5
C. 6
D. 10

Content: Number Theory
Process: Reasoning and Analysis

Use the picture below to answer the question that follows.

Add: $\frac{1}{3} + \frac{1}{3} = ?$

A. $\frac{1}{3}$
B. $\frac{2}{3}$
C. $\frac{2}{6}$
D. $\frac{1}{9}$

Content: Operations - Fractions
Process: Procedural Knowledge

Perimeter, Area, Volume. Results will not be reported separately for this category at this grade level; however, a few items in this category will contribute to the score in the broader category of "Measurement and Geometry." Questions involve area via unit square coverings (including partial units) and perimeter as distance around a figure.

Plane and Solid Figures. This category covers the recognition of simple plane and solid figures and knowledge and use of their properties.

Transformations/Spatial Visualization. Questions in this category involve the visualization of solid figures and cross sections, recognition of symmetric figures ("can be folded"), and identification of congruent ("same") and similar ("same shape") figures.

PROBLEM SOLVING SKILLS

Estimation and Reasonableness. Tested in this category are estimation skills requiring rounding prior to computation in both computation and story problem contexts. Questions addressing reasonableness of answers present problem situations with incomplete information and give numerical answer options differing by vast amounts.

Strategies. Strategy questions ask students to identify the appropriate number sentences, operations, or diagrams one might use to solve problems. Others ask the students to determine or complete the next step in a strategy already being applied to a problem situation.

Relevant Information. Questions on relevance of information ask students to identify the information that is missing or not needed to solve story problems.

PROBABILITY AND STATISTICS

Probability and Statistics. Questions in this category deal with informal probability (e.g., spinner problems with probability related to areas of regions) and simple permutations and combinations.

Graphs, Tables, and Charts. This category covers the reading and interpreting of maps, tables, charts, and graphs (bar, line, pie, picto).

Paula bought a pen for 50 cents and 2 apples, each costing 15 cents. How much change did she get back from $1.00?

A. 20 cents
B. 35 cents
C. 65 cents
D. 80 cents

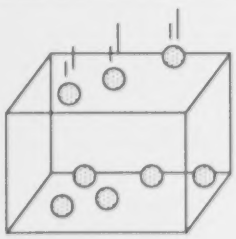
Content: Operations - Fractions/Decimals
Process: Problem Solving

What number belongs in the box?

$$33 + 25 = \square + 33$$

A. 8
B. 25
C. 33
D. 58

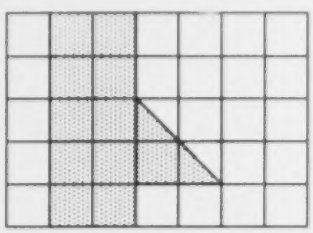
Content: Properties of Operations
Process: Reasoning and Analysis



Which number sentence shows what is happening in the picture above?

A. $5 - 3 = 2$
B. $3 \times 5 = 15$
C. $5 + 3 = 8$
D. $3 + 2 = 5$

Content: Variables and Relations
Process: Conceptual Understanding



What is the area of the shaded figure?

A. 10
B. 12
C. 13
D. 16

Content: Perimeter, Area, Volume
Process: Conceptual Understanding

Sample Questions

What will the object above look like when viewed from directly above it?

A.

B.

C.

D.

Content: Transformations/Spatial Visualization
Process: Reasoning and Analysis

> The Smiths have a cat and a grown-up German Shepherd dog. How much do the Smiths pay for pet food every month?

Not enough information is given to compute an answer to the problem in the box above. But which of the following would be the most likely answer?

A. $ .30
B. $3.00
C. $30.00
D. $300.00

Content: Estimation and Reasonableness
Process: Problem Solving

Annette has just added the prices of the two items she is going to buy in a store. What should she do **next** to find the change she will get if she pays with a $5.00 bill?

A. divide the sum of the two prices by two
B. find the total cost of the items
C. subtract the sum she found from $5.00
D. add the total she obtained to $5.00

Content: Strategies
Process: Problem Solving

Sample Questions

A player wins at a dart game if the player throws a dart that lands in a "3" area. Which dartboard below would give the player the best chance of winning?

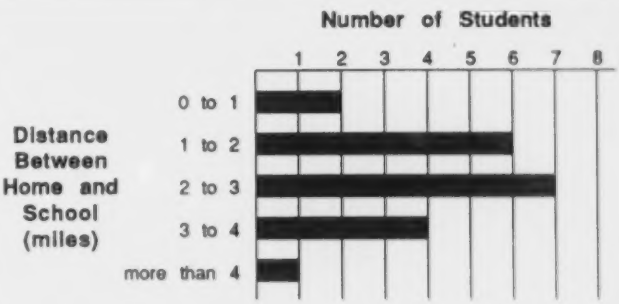
A.

B.

C.

D.

Content: Probability and Statistics
Process: Reasoning and Analysis



According to the graph, more than half of the students live

A. between 0 and 2 miles from school.
B. between 2 and 3 miles from school.
C. between 2 and 4 miles from school.
D. more than 3 miles from school.

Content: Graphs, Tables, Charts
Process: Reasoning and Analysis

Description of Content Categories — Grade 8

Content Description by Reporting Category

NUMBERS AND NUMERATION

Numeration. Topics and skills in this category include place value (whole numbers and decimal fractions), rounding, interpolation using the number lines and scales, recognition of fractional parts (common and decimal) as partitions of sets and parts of whole, and equivalent fractions and mixed numerals.

Number Theory. Topics covered include number sequences; odd, even and prime numbers; common multiples, factors, and denominators; set theory/membership.

OPERATIONS

Whole Numbers. Assessment questions in this category cover computation (all operations) as well as story problems (routine, nonroutine, one-step, and two-step).

Fractions. This category covers all operations with fractions and mixed numerals and story problems requiring these skills.

Decimals. Questions in this category involve computations (all operations) with decimal numerals/fractions and story problems requiring these skills with an emphasis on consumer problems involving money.

Percents. Questions involve finding the part, whole, or percentage given two of these three elements, understanding of the concept of percentage and percents greater than 100, and consumer-oriented story problems pertaining to such things as sale price, interest, tax, etc.

Integers. Although not a separate reporting category at this grade level, this category includes computations with integers that contribute to scores in the broader category of "Operations."

Properties of Operations. Questions in this category stress the understanding and application (and not knowledge of terminology) of properties, such as the commutative, associative, and distributive properties; elements of a number system (e.g., additive inverse, identity element of multiplication); and concepts of operations and algorithms (e.g., multiplication as repeated addition).

Sample Questions

Which number is between .04 and .05?

A. .005
B. .03
C. .045
D. .45

Content: Numeration
Process: Conceptual Understanding

Which of the following is a factor of 18?

A. 6
B. 12
C. 36
D. more than one of the above

Content: Number Theory
Process: Conceptual Understanding

Fred wrote this subtraction exercise on his paper:

19.1 - .09 = 19.01

His teacher marked it wrong. Which of the following best explains why it was marked wrong?

A. Fred does not know his basic subtraction.
B. Fred does not understand decimal places.
C. Fred does not know the rule for "borrowing" in subtraction.
D. The teacher made a mistake: Fred's answer is correct.

Content: Operations - Decimals
Process: Procedural Knowledge

Linda's new bike cost $159.99 and the sales tax was 5%. How much did she pay including tax?

A. $164.99
B. $167.99
C. $172.98
D. $177.99

Content: Operations - Percent
Process: Problem Solving

VARIABLES AND RELATIONS

Questions in this category involve such things as simple substitutions, solving simple equations and inequalities, and understanding coordinates/ordered pairs and graphic representation of relations and solution sets.

MEASUREMENT AND GEOMETRY

Using Instruments. Questions in this category will cover the reading of instruments (e.g., clock, metric and English rulers, thermometers, scales) with greater precision than at grade 4.

Units. This category covers the recognition of appropriate metric and English units for use in measuring various quantities (e.g., distance/length, weight); recognition of unit equivalents; conversion of units; use of unit equivalents in problems involving money, time, length, weight, etc. (e.g., problems involving scale drawings and proportional reasoning); and the relationship between measurement (quantity) and size of measurement unit.

Perimeter, Area, Volume. Questions involve area via unit square coverings (including partial units), perimeter and area of familiar figures and irregular shapes that can be partitioned into regular shapes, volume as unit cubes, and volume of rectangular solids.

Plane and Solid Figures. This category covers knowledge of angles and angle measures, intersecting and parallel lines, the recognition of simple plane and solid figures and knowledge and use of their properties.

Transformations/Spatial Visualization. Questions in this category involve the visualization of cross sections and networks of solid figures, understanding of reflections and symmetry, and identification of congruent and similar figures.

PROBLEM SOLVING SKILLS

Estimation and Reasonableness. Tested in this category are estimation skills requiring rounding prior to computation in both computation and story problem contexts. Questions addressing reasonableness of answers present problem situations with incomplete information and give numerical answer options differing by vast amounts.

Strategies. Strategy questions ask students to identify the appropriate number sentences, operations, tables, or diagrams one might use to solve problems. Others ask the students to determine or complete the next step in a strategy already being applied to a problem situation.

If $x = 5$ and $y = 10$, what does $5x + 2y$ equal?

A. 22
B. 45
C. 75
D. 265

Content: Variables and Relations
Process: Procedural Knowledge

A taxi driver charges $1.50 plus 20 cents per mile for a ride. What formula could the driver use to compute the cost (C) of a ride if d is the distance driven in miles?

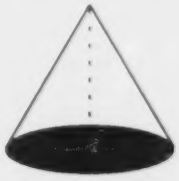
A. $C = 1.70d$
B. $C = 1.50d + .20$
C. $C = 1.50 + .20d$
D. $C = d + 1.70$

Content: Variables and Relations
Process: Conceptual Understanding

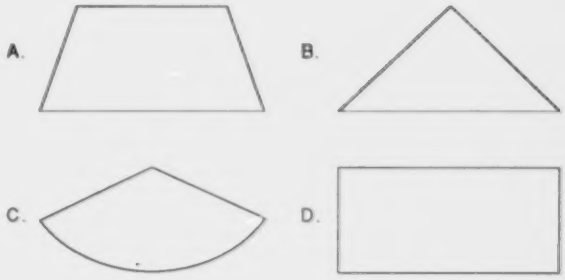
Two inches on a map represent 150 miles in actual distance. How far is Cooperville from Landsdown if they are 5 inches apart on the map?

A. 60 miles
B. 66.7 miles
C. 375 miles
D. 1500 miles

Content: Units
Process: Problem Solving



If the paper hat is cut along the dotted line and flattened, what shape will it have?



Content: Visualization
Process: Reasoning and Analysis

Four eighth graders estimated the number of times a social studies teacher asked students a question on a typical school day. Which estimate below do you think is most reasonable?

A. 10
B. 150
C. 1000
D. 2500

Content: Reasonableness
Process: Problem Solving

Relevant Information. Questions ask students to identify the information that is missing or not needed to solve story problems.

PROBABILITY AND STATISTICS

Probability and Statistics. Questions in this category deal with informal probability (e.g., spinner problems with probability related to areas of regions), computation of exact probabilities, permutations and combinations, and meaning and computation of averages.

Graphs, Tables, and Charts. This category covers the reading and interpreting of maps, tables, charts, and graphs (bar, line, pie, picto).

What would help **most** to solve the problem in the box?

> Julie and Joe are standing 10 feet apart. How many spots are there that are 15 feet from each of them?

A. using an equation
B. drawing a diagram
C. guessing, then testing
D. making a table

Content: Strategies
Process: Problem Solving

A jar contains 6 red marbles, 4 blue marbles, and 2 green marbles. Which is the most likely result of selecting a marble without looking

A. getting a green marble
B. getting a red marble
C. not getting a green marble
D. not getting a red marble

Content: Probability
Process: Reasoning and Analysis

Description of Content Categories — Grade 12

Content Description by Reporting Category	Sample Questions

NUMBERS AND NUMERATION

Numeration. Topics and skills in this category include place value (decimal numerals), rounding, interpolation using the number lines and scales (whole numbers, fractions, decimals, integers, irrational numbers), recognition of fractional parts (common and decimal) as partitions of sets and parts of whole, equivalent fractions and mixed numerals, and scientific notation.

Number Theory. Topics covered include number sequences; odd, even and prime numbers; common multiples, factors, and denominators; divisibility; set theory/membership.

What are the prime factors of 18?

A. 1 X 2 X 3 X 6 X 9 X 18
B. 2 X 3 X 3
C. 3 X 6
D. 2 X 3 X 7

Content: Number Theory
Process: Conceptual Understanding

A six-pack of soda contains 72 fluid ounces of soda and costs $1.68. A large plastic bottle of soda contains 59 fluid ounces of soda and costs $1.45. Which is the better buy?

A. the six-pack of soda
B. the plastic bottle of soda
C. They are equally as economical.
D. More information is needed.

Content: Decimals
Process: Problem Solving

OPERATIONS

Whole Numbers. Assessment questions in this category cover computation (all operations) as well as story problems (routine, nonroutine, one-step, and two-step).

Fractions. This category covers all operations with fractions and mixed numerals as well as routine and nonroutine story problems requiring these skills (including some ratio and proportion problems).

Decimals. Questions in this category involve computations (all operations) with decimal numerals/fractions as well as routine and nonroutine story problems requiring these skills with an emphasis on consumer problems involving money.

Percents. Questions involve finding the part, whole, or percentage given two of these three elements, understanding of the concept of percentage and percents greater than 100, and consumer-oriented routine and nonroutine story problems pertaining to such things as sale price, interest, tax, etc.

Integers. This category includes computations with integers and applications of these skills in routine and nonroutine story problems.

24 is what percent of 80?

A. 30
B. 33
C. 19.2
D. 1.9

Content: Operations - Percent
Process: Procedural Knowledge

Which of the following is a **false** statement?

A. $a(b - c) = ab - ac$
B. $a - bc = (a - b) \times c$
C. $a + (bc) = bc + a$
D. $\frac{a}{b} \times c = c \times \frac{a}{b}$

Content: Properties of Operations
Process: Conceptual Understanding

VARIABLES AND RELATIONS

Algebraic Manipulations. Skills assessed in this category include such things as simplifying algebraic expressions, factoring, combining terms, and substitution.

Relations/Functions. Covered in this category are the concept of functions, graphs of functions (linear, quadratic, higher order), direct and inverse variation, the translation of verbal problems into algebraic equations of expressions, and interpretation (meaning) of algebraic expressions.

Equations and Inequalities. Questions in this category involve the solving of equations and inequalities, and the solving of word problems lending themselves to algebraic solution.

MEASUREMENT AND GEOMETRY

Using Instruments. Questions in this category will cover the reading of instruments (e.g., clock, metric and English rulers, thermometers, scales, protractors) with greater precision than at grade 4.

Units. This category covers the recognition of appropriate metric and English units for use in measuring various quantities (e.g., distance/length, weight); recognition of unit equivalents; conversion of units; and use of unit equivalents in problems involving money, time, length, weight, etc. (e.g., problems involving scale drawings and proportional reasoning).

Perimeter, Area, Volume. Questions involve area via unit square coverings (including partial units), perimeter and area of familiar figures and irregular shapes that can be partitioned into regular shapes, volume as unit cubes and volume of rectangular solids, the relationship between measurement (quantity) and size of measurement unit, and problems involving perimeter, area, and volume (e.g., amount of grass seed needed to cover ...).

Plane and Solid Figures. This category covers knowledge of angles and angle measure, intersecting and parallel lines, the recognition of simple plane and solid figures and knowledge and use of their properties.

Transformations/Spatial Visualization. Questions in this category involve the visualization of cross sections and networks of solid figures, understanding of reflections and symmetry, and understanding and application of the concepts of congruence and similarity.

The following formula can be used to determine the cost of hiring a band:

$$C = 75 + 20h$$

where C is the total cost and h is the number of hours the band plays.

According to this formula, how much more does the band cost for every individual hour?

A. 95
B. 75
C. 55
D. 20

Content: Relations/Functions
Process: Conceptual Understanding

It takes 35 minutes per pound to roast a chicken. If a chicken weighs 6 pounds and is to be done at 7:00 pm, what time should it be put in the oven?

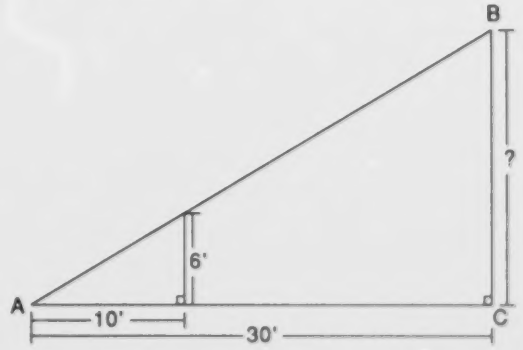
A. 2:30
B. 3:30
C. 4:30
D. 5:10

Content: Units
Process: Problem Solving

One box of roofing shingles will cover 100 square feet. How many boxes of shingles would be needed to cover a flat roof that is 35 feet long and 25 feet wide?

A. 6
B. 7
C. 8
D. 9

Content: Perimeter, Area, Volume
Process: Problem Solving



What is the length of side BC in the large triangle above?

A. 12 feet
B. 18 feet
C. 36 feet
D. 46 feet

Content: Transformations
Process: Reasoning and Analysis

PROBLEM SOLVING SKILLS

Estimation and Reasonableness. Tested in this category are estimation skills requiring rounding prior to computation in both computation and routine and nonroutine story problem contexts. Questions addressing reasonableness of answers present problem situations with incomplete information and give numerical answer options differing by vast amounts.

Strategies. Strategy questions ask students to identify the appropriate number sentences, operations, tables, or diagrams one might use to solve problems. Others ask the students to determine or complete the next step in a strategy already being applied to a problem situation.

Relevant Information. Questions ask students to identify the information that is missing or not needed to solve story problems.

PROBABILITY AND STATISTICS

Probability. Questions in this category deal with informal probability (e.g., spinner problems with probability related to areas of regions), computation of exact probabilities, permutations and combinations.

Statistics. Questions deal with the meaning and determination of measures of central tendency (average), the meaningfulness of different statistics depending on the situation and variable in question, and other aspects of data reduction or simplification.

Graphs, Tables, and Charts. This category covers the reading and interpreting of maps, tables, charts, and graphs (bar, line, pie, picto).

A researcher has an alphabetical listing of the 403 elementary schools in a state. Next to each school name is the number of fourth graders in the school. The number of fourth graders in the first 50 schools listed is 3021. Which of the following is the best estimate of the total number of fourth grade students in the state?

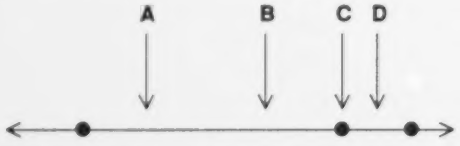
A. 2500
B. 24,000
C. 40,000
D. 60,000,000

Content: Estimation
Process: Problem Solving

Two fair coins are tossed. What are the chances that **at least** one head will appear?

A. 1 in 2
B. 1 in 3
C. 1 in 4
D. 3 in 4

Content: Probability
Process: Reasoning and Analysis



The three dots above represent numbers on a number line. Which arrow points to the average of the three numbers?

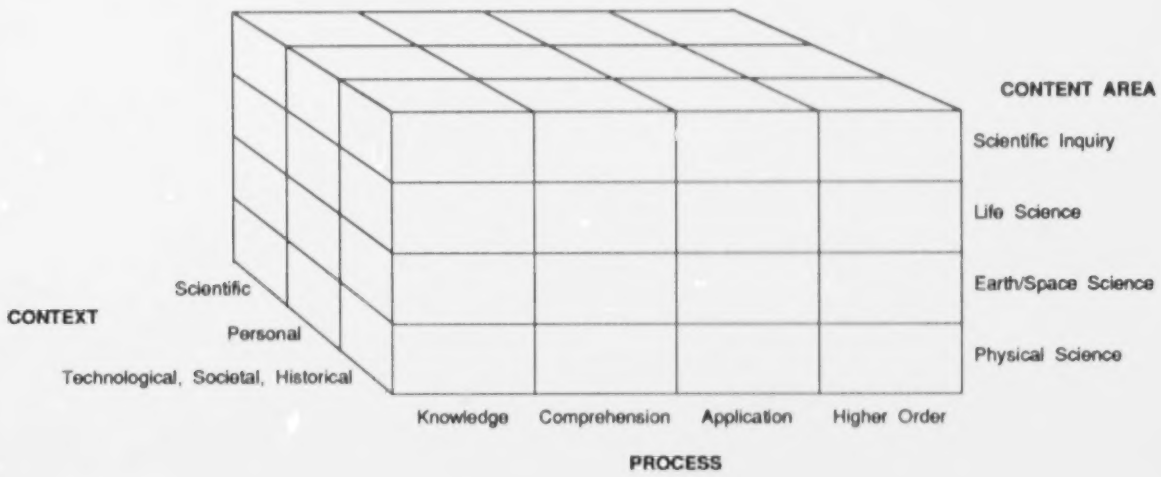
A. Arrow A
B. Arrow B
C. Arrow C
D. Arrow D

Content: Statistics
Process: Conceptual Understanding

SCIENCE

Framework for Science

School scores will be reported for each of the content, process, and context categories shown in the figure below. Also, school scores will be produced for various content subcategories.



The content subcategories are described in great detail in the next two sections of this report. The process dimension is based on Bloom's Taxonomy of Cognitive Objectives. (For an explanation of the cognitive processes, see the description of them presented on page 3 in the chapter on social studies.) The process and context categories are further clarified through the presentation of sample questions in the subsequent sections.

The descriptions of the reporting categories on the following pages list important, broad concepts within the various categories. Lists of specific examples given after many of the concepts are provided for clarification of the concepts and are **not** intended to represent specific items on the test.

Grade 4, 8, and 12 Reporting Categories — Content Dimension

	Estimated # Items		
	Grade 4	Grade 8	Grade 12
I. Scientific Inquiry	51	56	69
A. Designing Investigations	15	15	18
B. Data Gathering/Reduction	16	20	25
C. Data Interpretation	15	15	19
D. Nature of Science	*5	*6	*7
II. Life Science	75	75	110
A. Characteristics of Life	15	15	21
B. Health	15	15	21
C. Animal Life	15	15	22
D. Plant Life	15	15	21
E. Ecology and Environment	15	15	25
III. Earth and Space Science	46	55	80
A. Astronomy	15	16	19
B. Meteorology	15	16	19
C. Geology and Natural Resources (and Oceanography at grades 4 and 8)	16	23	23
D. Oceanography			19
IV. Physical Science	48	69	102
A. Matter	16	23	36
B. Energy	16	23	33
C. Force and Motion	16	23	33
	220 items	255 items	361 items

* not reported separately

Description of Content Categories — Grade 4

Content Description by Reporting Category

SCIENTIFIC INQUIRY

Designing Investigations. Students are expected to identify the best step or sequence of steps to investigate a problem or answer a question, identify the question the answer to which would be most helpful in solving a problem, recognize relevant variables (most important information to collect), and understand the notion of a sample representing a larger group.

Data Gathering/Reduction (i.e., simplifying, consolidating, processing). Students should be able to determine the best method to collect information in a situation (observe, measure, ask), identify appropriate instruments and read them; identify appropriate units (metric and English); understand measurement is not absolute/exact; sort or order objects, ideas, and data; identify similarities, differences, patterns; make observations; recognize appropriate ways of summarizing or displaying information or data for given purposes.

Data Interpretation. Students are to demonstrate the ability to read and interpret graphs and tables, draw and evaluate conclusions from data, identify strongest evidence of a conclusion, use deductive logic, and generalize to the appropriate level.

Nature of Science. Students should have an understanding of the purposes and roles of science in society, science-society interactions, responsibilities of scientists, characteristics of scientists and scientific activity (e.g., science not exact, knowledge changes).

LIFE SCIENCE

Characteristics of Life. Topics covered include classifications of living things, basic life functions (e.g., reproduction, digestion) of all living things; inheritance of traits from parents, organization of living things (cells, organs, systems); and life cycles/stages.

Health. Health topics included in the assessment are nutrition (balanced diet, best sources of basic food groups), substance abuse, personal hygiene and health maintenance, treatment of illness.

Animal Life. Topics covered include characteristics of more familiar classifications of animals, functions and interaction of organs and systems, animal behavior (territoriality, instincts, hibernation, migration).

Sample Questions

Chris wants to find out which of two laundry soaps is best. Chris washes two loads of dirty clothes. What should be different about the two loads?

A. the kind of clothes
B. the type of dirt
C. the temperature of the water
D. the brand of soap

Content: Designing Investigations
Process: Higher Order
Context: Personal

	Favorite Color	Favorite Sport	Favorite Subject	Favorite Food
Chris	red	soccer	math	hamburger
Pat	blue	football	reading	pizza
Julio	green	soccer	science	steak
Maria	blue	soccer	math	hamburger
Eddie	red	basketball	soc. studies	hamburger

How many of the 5 people above like soccer and hamburger best?

A. 1
B. 2
C. 3
D. 4

Content: Data Getting/Reduction
Process: Higher Order
Context: Scientific

Scientists help society most by

A. doing experiments.
B. solving problems.
C. writing reports.

Content: Nature of Science
Process: Comprehension
Context: Societal/Technological/Historical

Plant Life. Included in this area are the characteristics of more familiar classifications of plants, functions of plant parts, and the requirements and products of photosynthesis.

Ecology and Environment. In the area of ecosystems and ecological balance, topics covered are predator/prey relationships; food chains; disruptions of ecological balance; habitats; cycles (oxygen, water, energy); and pollution (types, causes, impacts, prevention).

EARTH AND SPACE SCIENCE

Astronomy. Topics covered include components of our solar system (planets, stars, etc.); relative positions and motions of the earth, moon, and sun; and space exploration.

Meteorology. Aspects of weather addressed in the assessment are weather characteristics (wind, temperature, climate differences), forms of precipitation and clouds, weather instruments, and the water cycle.

Geology/Natural Resources/Oceanography. Topics include the make-up of the earth, landforms, changes in the earth's surface, natural resources, characteristics of ocean environment(s), habitats and lifeforms, and ocean movements (tides, waves).

PHYSICAL SCIENCE

Matter. Chemistry concepts covered include characteristics of materials — density (floating objects), states of matter (solid, liquid, gas), types of matter (natural, man-made), physical and chemical changes, expansion, contraction.

Energy. Major topics include light, sound, electricity, heat, and magnetism; conductivity (conductors of heat and electricity); energy conversion (changing forms); and techniques of energy conservation (home, community, nation).

Force and Motion. Concepts of mechanics covered are basic concepts and quantities (force, gravity, weight, balance, speed), laws of motion (action-reaction, inertia), and simple machines.

Which of the following is a material plants must have to make food?

A. oxygen
B. water
C. sugar
D. vitamins

Content: Plant Life
Process: Knowledge
Context: Scientific

What happens to the pollutants in smoke released by a factory's smokestack?

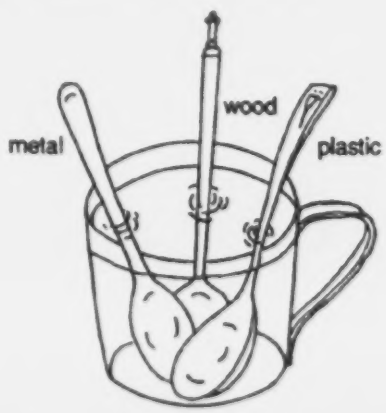
A. They stay in the air forever.
B. They eventually fall to earth as acid rain.
C. They escape from the atmosphere into space.

Content: Ecology and Environment
Process: Comprehension
Context: Societal/Technological/Historical

Which of the following could cause mountains to form?

A. hurricanes
B. tornadoes
C. volcanoes
D. floods

Content: Geology
Process: Knowledge
Context: Scientific



A metal spoon, a wooden spoon and a plastic spoon are placed in hot water to soak. Which spoon will feel hottest?

A. the metal spoon
B. the wooden spoon
C. the plastic spoon
D. The three spoons will feel the same.

Content: Energy
Process: Application
Context: Personal

In which change is a new material formed?

A. ice melting
B. paper tearing
C. wood burning
D. glass cracking

Content: Matter
Process: Comprehension
Context: Scientific

Description of Content Categories — Grade 8

Content Description by Reporting Category

SCIENTIFIC INQUIRY

Designing Investigations. Students are expected to identify testable hypotheses, match hypotheses to research questions and to most appropriate designs for experiments and investigations, identify relevant and irrelevant variables (most important information to collect), understand and recognize the importance of control of variables in experimentation, and recognize independent and dependent variables.

Data Gathering/Reduction. Students should be able to recognize good and poor sampling, recognize and use appropriate instruments to extend their senses; identify appropriate units (metric and English); understand measurement and measurement error; sort or order objects, ideas, and data; identify similarities, differences, patterns and categories; make observations; recognize appropriate methods of simplifying and summarizing data (e.g., counting, averaging, graphic display); identify and produce most appropriate graphs, tables, etc.

Data Interpretation. Students are to demonstrate the ability to read and interpret graphs and tables, draw and evaluate conclusions from data, identify strongest evidence of a conclusion, use deductive logic, generate models, and generalize to the appropriate level.

Nature of Science. Students should have an understanding of the purposes and roles of science in society, science-society interactions (population dynamics), responsibilities of scientists, characteristics of scientific activity (e.g., science not exact, knowledge evolves).

LIFE SCIENCE

Characteristics of Life. Topics covered include classifications of living things, basic life functions (e.g., reproduction, digestion) of all living things; concepts of genetics/heredity; concepts of evolution; organization of living things (cells, tissues, organs, systems); and life cycles/stages.

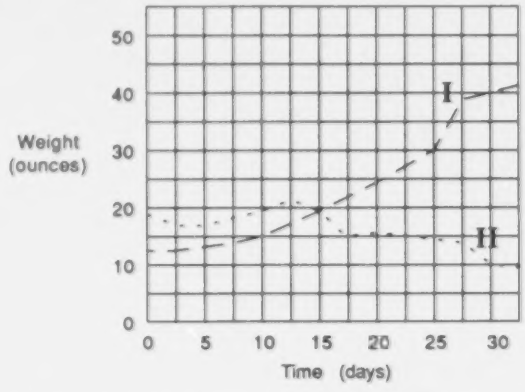
Health. Health topics included in the assessment are nutrition (diet, basic food groups), diseases (causes, characteristics, immunology, treatment, transmission, prevention), substance abuse, personal hygiene and health maintenance, and human reproduction (birth control, sexually transmitted disease).

Sample Questions

John wants to find out which of two brands of paper towels is most absorbent. He pours water in two places on a counter and tries out each brand. Which of the following is **least** important to keep the same in each case?

A. the amount of water
B. the number of towels
C. the time allowed for absorbing
D. the temperature of the water

Content: Designing Investigations
Process: Higher Order
Context: Personal



Two guinea pigs, I and II, were put on different diets for a month. The graph above shows what happened to their weights. Which of the following statements is correct according to the information in the graph?

A. Guinea pig II's diet was more effective at first.
B. Guinea pig II ate less food than guinea pig I.
C. The two guinea pigs weighed the same on the 15th day.
D. Guinea pig I was a healthier guinea pig.

Content: Data Interpretation
Process: Higher Order
Context: Scientific

Bacteria are produced by

A. flies.
B. rodents.
C. other bacteria.
D. unclean water.
E. more than one of the above.

Content: Characteristics of Life
Process: Comprehension
Context: Scientific

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Animal Life. Topics covered include characteristics of more familiar classifications of animals, functions and interaction of organs and systems, animal behavior (territoriality, rituals, instincts).

Plant Life. Included in this area are the characteristics of more familiar classifications of plants, functions of plant parts, and the requirements and products of photosynthesis.

Ecology and Environment. In the area of ecosystems and ecological balance, topics covered are predator/prey relationships; food pyramids, chains, webs; disruptions of ecological balance; population growth; habitats; cycles (oxygen, water, energy); and pollution.

EARTH AND SPACE SCIENCE

Astronomy. Topics covered pertaining to the solar system include characteristics of planets, stars, etc.; relative positions and motions of the earth, moon, and sun; and space exploration.

Meteorology. Aspects of weather addressed in the assessment are weather characteristics (wind, humidity, pressure, temperature), forms of precipitation, and weather prediction/change, the water cycle, and climate.

Geology/Natural Resources/Oceanography. Topics include geologic time, evolution of the earth as a planet, plate tectonics (mountains, earthquakes, volcanoes, sea floor spreading) and the rock cycle (earth materials, weathering, and erosion), natural resources, chemical and physical characteristics of the ocean, ocean movements, marine geology (e.g., coastal and sea floor characteristics), and marine habitats.

PHYSICAL SCIENCE

Matter. Chemistry concepts covered include characteristics of materials (density, conductivity, magnetic properties), states of matter, conservation of matter, structure/types of matter (atomic/molecular structure, elements, compounds, etc.), physical and chemical changes, gas laws (relations among pressure, temperature, volume).

Energy. Major topics include waves/optics (characteristics of waves - light/sound, reflection and refraction), heat and heat transfer, energy conversion (forms of energy, conservation of energy), electricity (circuits, electrical components), magnetism, and techniques of energy conservation.

Today, almost no one gets polio because

A. doctors have found new drugs which cure polio when it happens.
B. bad water, which used to cause polio, has been cleaned up.
C. people eat better food and get more exercise, so they are healthier.
D. people are given a vaccine which keeps them from getting polio.

Content: Health
Process: Comprehension
Context: Societal/Technological/Historical

Which of the following is **most likely** to contaminate the drinking water in a well in a family's back yard?

A. planting a vegetable garden nearby
B. fertilizing the lawn
C. throwing rocks into the well
D. building a tool shed nearby

Content: Ecology and Environment
Process: Higher Order
Context: Personal

One characteristic common to the planets is that all of them

A. are orbited by moons.
B. are composed of gas.
C. have atmospheres.
D. reflect light.

Content: Astronomy
Process: Knowledge
Context: Scientific

What could happen if the forest on a mountainside were cleared?

A. colder temperatures in the foothills
B. less rain on the plains below
C. flooding of the plains below
D. more snow in the mountains

Content: Geology
Process: Application
Context: Societal/Technological/Historical

Force and Motion. Concepts of mechanics covered are basic concepts or quantities (velocity, force, work, inertia, acceleration), resultant (vector) forces, motion (laws of motion, relative motion, gravitational force), and simple machines.

The solid, liquid, and gaseous states of water differ in which of the following ways?

A. the number of protons per molecule
B. the electrical charge of the individual molecules
C. the average speed with which the molecules are moving
D. the number of hydrogen atoms per molecule

Content: Matter
Process: Knowledge
Context: Scientific

In which device is the **most important** energy change a conversion of heat energy into mechanical energy?

A. electric motor
B. steam engine
C. light bulb
D. clothes dryer

Content: Energy
Process: Higher Order
Context: Scientific

Description of Content Categories — Grade 12

Content Description by Reporting Category	Sample Questions

SCIENTIFIC INQUIRY

Designing Investigations. Students are expected to identify testable hypotheses, match hypotheses to research questions and to most appropriate designs for experiments and investigations, identify relevant and irrelevant variables (most important information to collect), understand and recognize the importance of control of variables in experimentation, and recognize independent and dependent variables.

Data Gathering/Reduction. Students should be able to recognize good and poor sampling, identify appropriate instruments and read them; identify appropriate units (metric and English); understand measurement and measurement error; sort or order objects, ideas, and data; identify similarities, differences, patterns; make observations; recognize appropriateness of frequency counts, averages, cross tabulations, and other summary/descriptive statistics and methods of displaying data; identify and produce most appropriate graphs, tables, etc.

Data Interpretation. Students are to demonstrate the ability to read and interpret graphs and tables, draw and evaluate conclusions from data, identify strongest evidence of a conclusion, use inductive and deductive logic, generate models, and generalize to the appropriate level.

Nature of Science. Students should have an understanding of the purposes and roles of science in society, science-society interactions (population dynamics), responsibilities of scientists, characteristics of scientific activity (e.g., science not exact, knowledge evolves).

LIFE SCIENCE

Characteristics of Life. Topics covered include classifications of living things, basic life functions (e.g., reproduction, digestion) of all living things; concepts of genetics/heredity; concepts of evolution; organization of living things (cells, tissues, organs, systems); and life cycles/stages.

Health. Health topics included in the assessment are nutrition (diet, basic food groups), diseases (causes, immunological characteristics, immunology, treatment), substance abuse, personal hygiene and health maintenance, and human reproduction (birth control, sexually transmitted disease).

Sam wanted to find out what percentage of the trees in a particular forest were oak trees. Instead of counting all the trees in the forest, he simply counted a sample of them — those in a few representative sections of the forest. For his estimate to be valid, which of the following must be true?

A. The selected areas must have more oak trees than other areas.
B. The sample of trees counted must be sufficiently large.
C. The sampling must be repeated over several months.

Content: Data Gathering/Reduction
Process: Application
Context: Scientific

Wanda believes that soccer players in her school tend not to take music classes as much as other students. What information should she compute to test her hypothesis?

A. the average number of soccer players and music students per year
B. the number of soccer players and number of non-soccer players taking music
C. the average grades of soccer players in music
D. the percentage of soccer players and percentage of non-soccer players taking music

Content: Data Gathering/Reduction
Process: Application
Context: Scientific

Which of the following is a good argument in support of the statement:

> The U.S. should build nuclear power plants to help meet its energy needs.

A. Nuclear energy offers a solution to our current energy problems but further research in waste disposal techniques is necessary before it can be considered a safe solution.
B. Nuclear power plants pollute less than other feasible energy sources and offer tremendous potential as energy sources.
C. Many marine biologists ignore the necessity of using alternative energy sources and are only concerned with the potential effects of nuclear power on marine ecosystems.
D. All of these are good arguments in support of the statement.

Content: Data Interpretation
Process: Higher Order
Context: Societal/Technological/Historical

Animal Life. Topics covered include characteristics of more familiar classifications of animals, functions and interaction of organs and systems, animal behavior (territoriality, rituals, instincts), and microorganisms.

Plant Life. Included in this area are the characteristics of more familiar classifications of plants, functions of plant parts, and the requirements and products of photosynthesis.

Ecology and Environment. In the area of ecosystems and ecological balance, topics covered are predator/prey relationships; food pyramids, chains, webs; populations and population growth and stability; disruptions of ecological balance; habitats; cycles (carbon, nitrogen, oxygen, water, energy); and pollution.

EARTH AND SPACE SCIENCE

Astronomy. Topics covered pertaining to the solar system include characteristics of planets, stars, etc.; relative positions and motions of the earth, moon, and sun; and space exploration.

Meteorology. Aspects of weather addressed in the assessment are weather characteristics (wind, humidity, pressure, temperature/climate differences), forms of precipitation, and weather prediction/change, and the water cycle.

Geology/Natural Resources. Topics include geologic time, evolution of the earth as a planet, plate tectonics (mountains, earthquakes, volcanoes, sea floor spreading) and the rock cycle (earth materials, weathering, and erosion), and natural resources.

Oceanography. Topics include chemical and physical characteristics of the ocean, ocean movements, marine geology (e.g., coastal and sea floor characteristics), and marine habitats.

In pea plants, height depends on one pair of genes. Tall is dominant over short. What will happen if a pure tall pea plant is crossed with a short one?

A. All of the offspring will be middle sized.
B. One-half of the offspring will be tall; one-half will be short.
C. Three-fourths of the offspring will be tall; one-fourth will be short.
D. All of the offspring will be tall.

Content: Characteristics of Life
Process: Application
Context: Scientific

Which of the following diseases is not directly transmitted among people in contact with each other?

A. herpes
B. influenza
C. tuberculosis
D. diabetes

Content: Health
Process: Knowledge
Context: Personal

Which is a cause of acid rain?

A. exhaust from automobiles
B. burning wood in a wood stove
C. factories burning coal
D. all of the above

Content: Ecology and Environment
Process: Knowledge
Context: Societal/Technological/Historical

Which of the following events probably occurred first in the earth's early history?

A. formation of the earth's molten core
B. formation of the continents
C. condensation of clouds into rain
D. eruption of volcanoes

Content: Geology
Process: Comprehension
Context: Scientific

PHYSICAL SCIENCE

Matter. Chemistry concepts covered include characteristics of materials (density, conductivity, radioactivity, magnetic properties), states of matter, conservation of matter, structure/types of matter (atomic/molecular structure, periodicity, elements, compounds, etc.), physical and chemical changes, reactions, chemical formulas and equations, fission and fusion, and gas laws (relations among pressure, temperature, volume).

Energy. Major topics include waves/optics (characteristics of waves - light/sound, reflection and refraction), heat and heat transfer, energy conversion (forms of energy, conservation of energy), electricity (circuits, electrical components), magnetism and magnetic fields, computer technology (e.g., impact of microchips), and techniques of energy conservation.

Force and Motion. Concepts of mechanics covered are basic concepts or quantities (momentum, velocity, force, work, inertia, acceleration), vector quantities (resultant forces, equilibrium), motion (laws of motion, relative motion, gravitational force, harmonic motion), and simple machines.

A nuclear-power reactor must be carefully monitored. It cannot, however, explode like an atomic bomb. Why?

A. The reactor turns itself off when it gets too hot.
B. The container of the reactor is too thick.
C. The nuclear reaction takes place too slowly in the reactor.
D. Uranium does not sustain fission.

Content: Matter
Process: Comprehension
Context: Societal/Technological/Historical

In which situation would the air pressure in an automobile tire be greatest?

A. in the morning after sitting all night
B. after sitting all afternoon in the hot sun
C. when first starting out on a trip
D. at the end of a long trip

Content: Matter
Process: Higher Order
Context: Personal

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